

ANNEX 2

TYPICAL EXAMPLES OF GAS MIXING
AND DISTRIBUTION SYSTEMS

This annex contains illustrations of typical gas mixing and distribution systems.

Figure 1 A complete gas distribution system divided into three separate areas; the storage and mixing areas and the experiment itself. These are physically isolated from each other and can be treated individually for Risk Classification.

The flammable gas undergoes primary distribution from its storage room. The non-flammable gases have their own storage and primary distribution area, and one of these gases is shown as being distributed from a Dewar. The mixed gas is split into many individually monitored channels in the experimental area before being passed through the detector units.

In this simple system, the output gas from the detectors is exhausted directly to the atmosphere.

Figure 2 A mixing system in which one of the components is supplied as a liquid which is evaporated into the carrier gas which is itself a mixture of gases.

Figure 3 A mixing system in which the return gas is recirculated.

Normally the return gas will pass through a purifier and some fraction of it will be exhausted to avoid the build up of impurities. The main flow is then topped up from the mixer.

Figure 4 Standard symbols used to represent components of gas distribution systems.

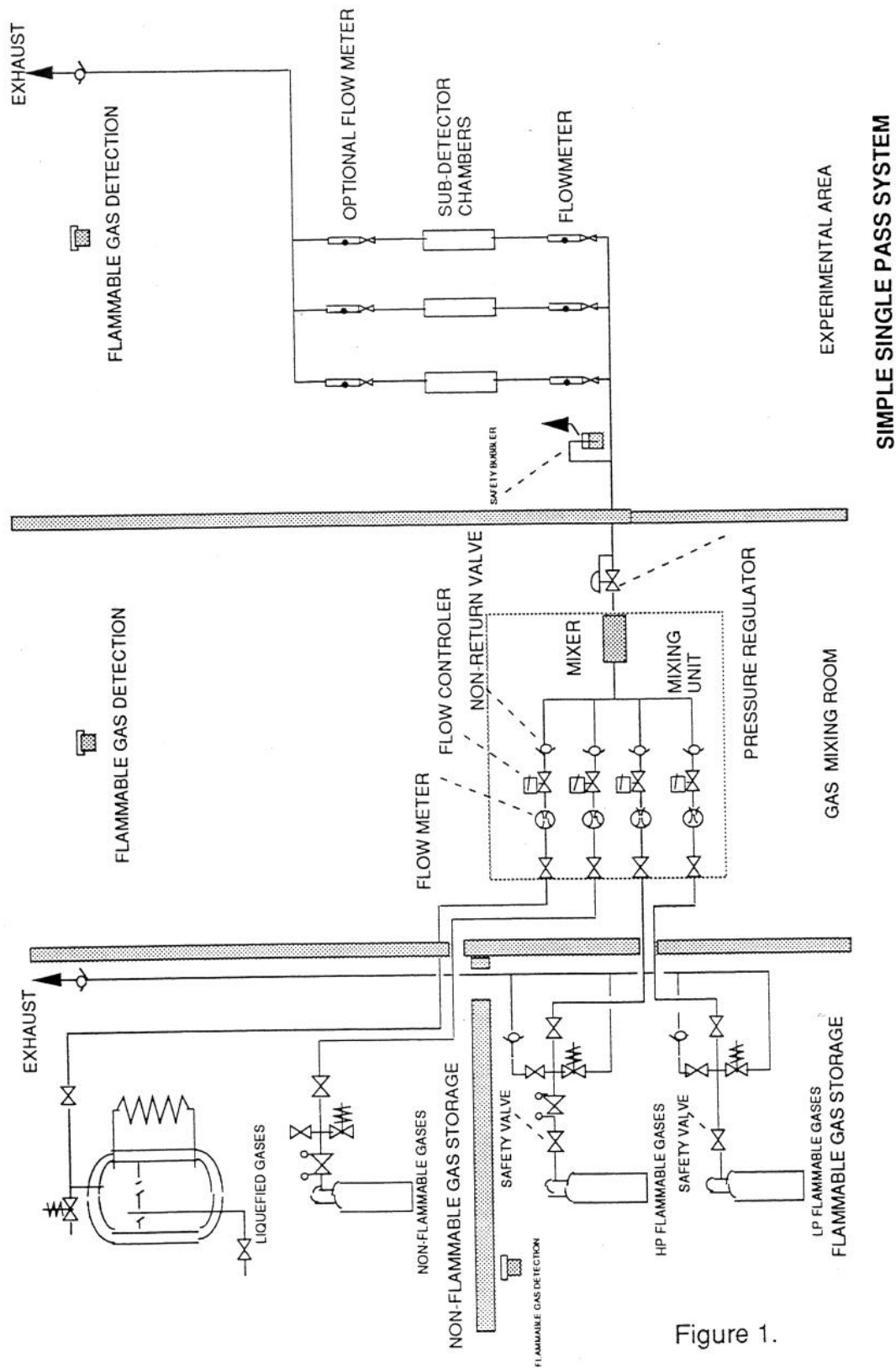


Figure 1.

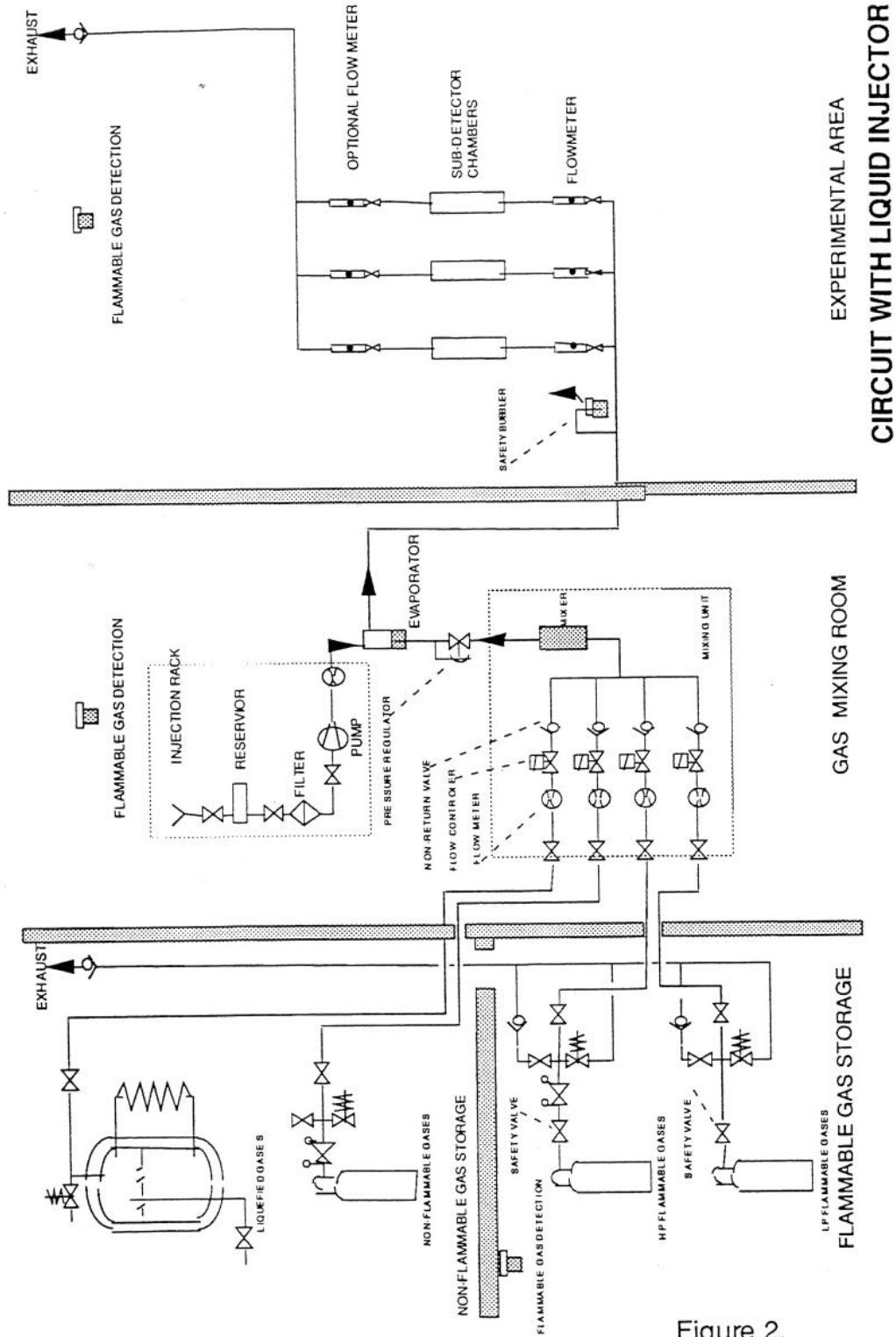


Figure 2.

EXPERIMENTAL AREA

CIRCUIT WITH LIQUID INJECTOR

GAS MIXING ROOM

FLAMMABLE GAS STORAGE

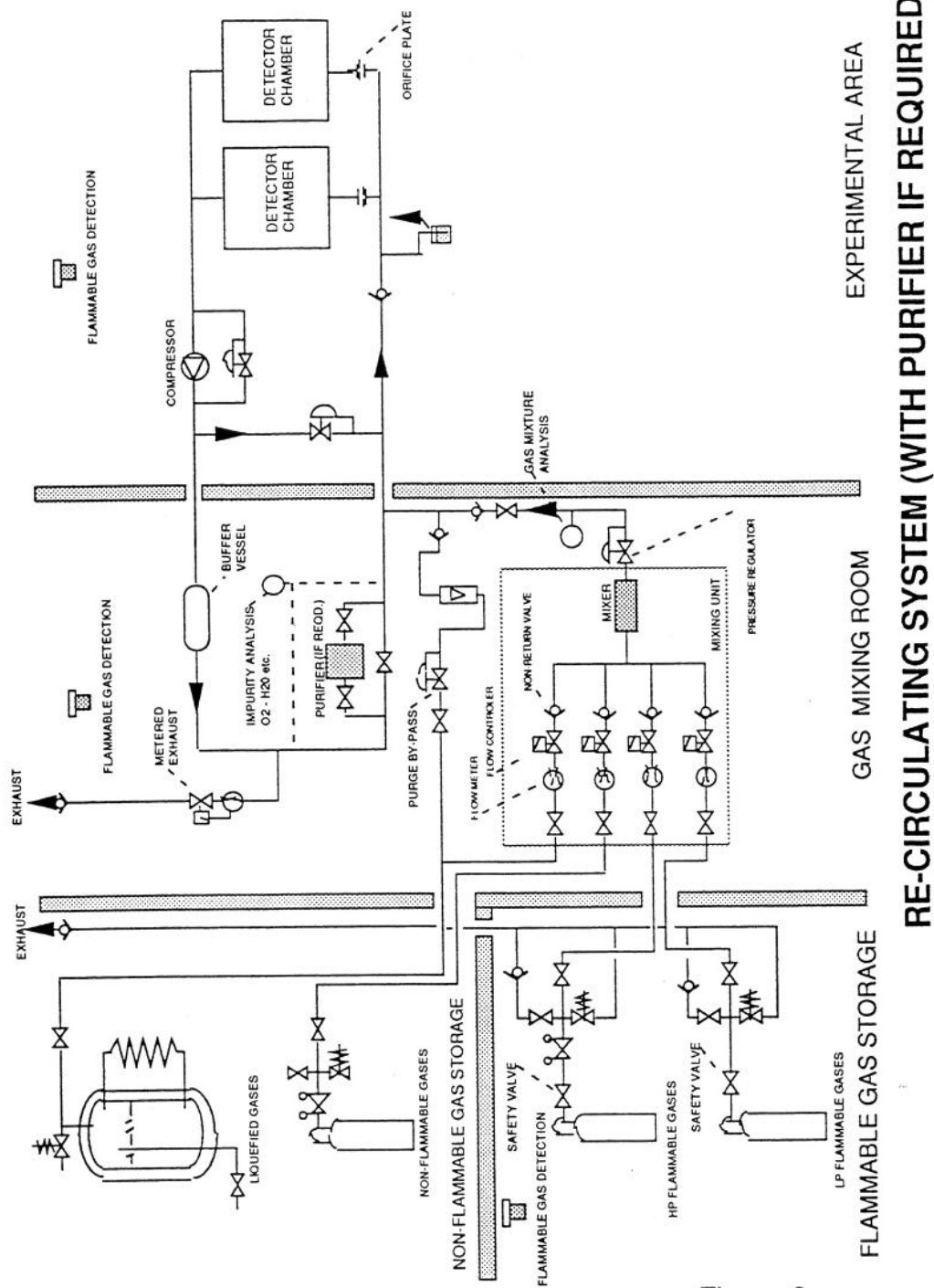
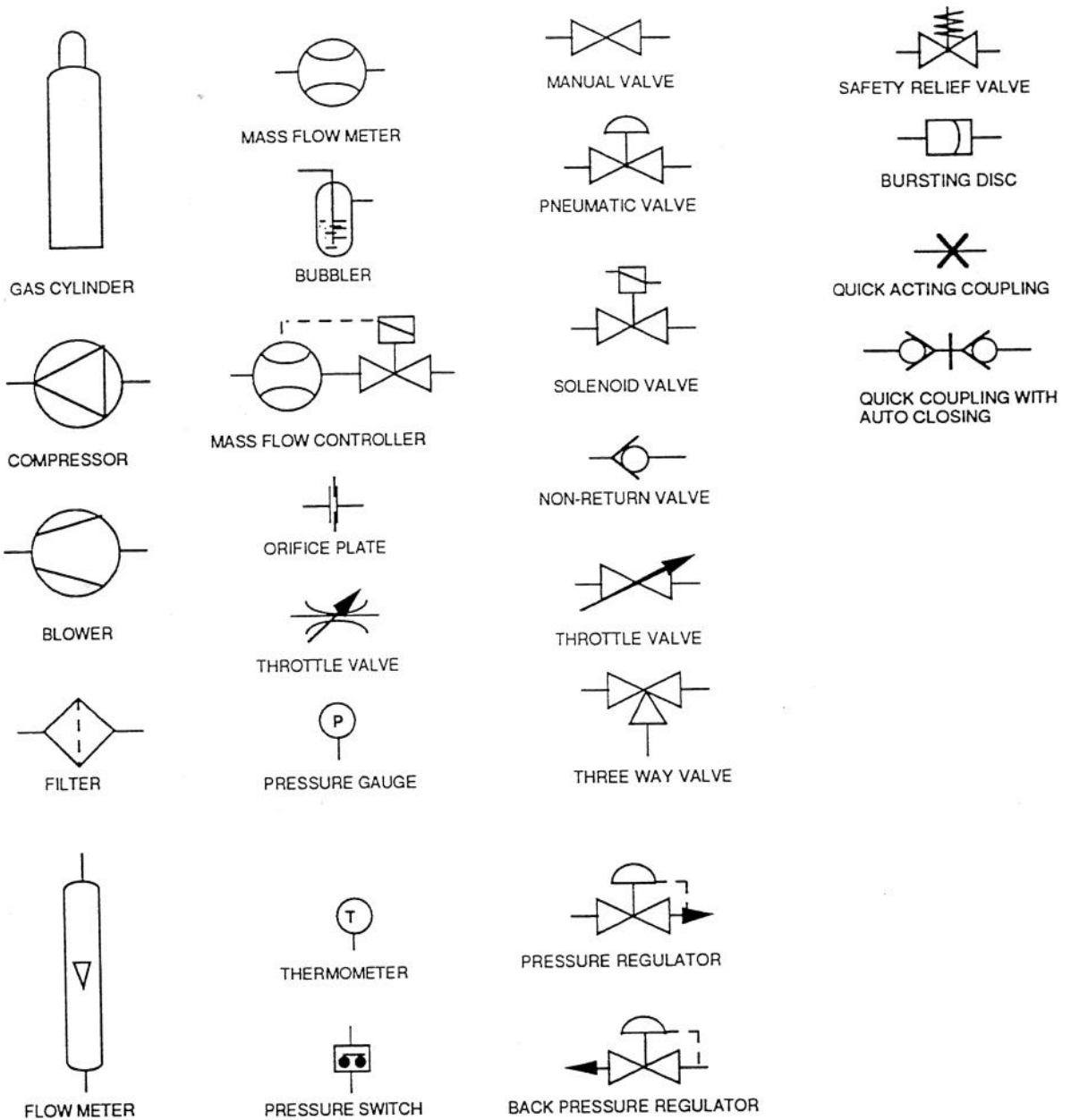


Figure 3.



TYPICAL FLOW SHEET SYMBOLS

Figure 4.

Table 1
Instruments suitable for Gas Analysis

Component to be Measured	Typical Range	Analytical Principle	Remarks
Oxygen	1-20ppm to 0 - 100%	Electrochemical Cell	Reasonably cheap. Cell has to be replaced periodically. Range has to be specified. Portable ones available.
Oxygen	0 - 30%	Para-magnetism	More expensive than above but no cell replacement. Not ppm range. Very stable. Portable ones available. Does not work in magnetic fields.
Oxygen	0.1ppm - 100%	Zirconia sensor	All ranges in one instrument. Precise. Cannot be used with flammable gases
Oxygen	to ppb	Gas phase chromatography	Accurate but expensive. May be used to detect other contaminants at the same time (e.g. HC, H ₂ , H ₂ O, N ₂ , Ar)
Water Vapour	to ppb	Gas phase chromatography	See above
Water Vapour	to low ppm	Near Infra Red (NIR)	Can be used in liquid phase.
Water Vapour	low ppm to %	Infra Red (IR)	Usually single gas or dual gas measurement. Multiple gas possible.
Water Vapour	1ppm-1000	Silicon sensor	Fast response time (about 5 mins).
Water Vapour	1ppm-4%	Aluminium Oxide sensor	Slow response time.
Water Vapour	ppm	Lithium chloride sensor	
Hydrocarbons (HC)	to ppb	Gas phase chromatography	See above. Can also be used to control the concentration of components of a gas mixture.
HC	ppm	Ultra-violet (UV)/visible photometry	Can be used to measure certain organics in inorganic gases and paraffin hydrocarbons. Can be used in liquid phase.
HC	low ppm	Flame ionisation	Sensitive but not specific. Can be used for measurements in inorganic gases or hydrogen
HC	ppm to %	IR	Depending on the specification, the apparatus can be used measure traces or to control the concentration of components of a gas mixture. Can measure several components.
HC	to ppb	Mass spectrometry	Sensitive and specific. Can be used in line with a gas chromatograph to identify species.
Hydrogen	ppm	Catharometer. Thermal Conductivity	Sensitive but not specific.
Hydrogen	ppm	Gas phase chromatography	See above
Rare Gases-Traces	ppm	Gas phase chromatography	See above
Rare Gases-Traces	ppm	Catharometer. Thermal Conductivity	Sensitive but not specific.